Single Electrode Dielectric/Conductivity Sensor Specifications

Figure 1
8-mm diameter unsheathed (left) / 0.5-inch diameter sheathed (right)
single electrode reusable dielectric sensors
(Rear exit versions shown)

DESCRIPTION

Suitable for R&D, QA/QC and manufacturing applications with repetitive operations, the 8-mm dia. unsheathed and 0.5-inch dia. sheathed single electrode sensors are designed for use in presses, molds or harsh environments where a tiny, reusable dielectric sensor is desired. They may be mounted so the electrode is flush with a platen or mold surface, insuring no interference with the flow of material during processing. These sensors are constructed with a stainless steel electrode embedded in a high temperature polymer insulator. An optional thermocouple may be positioned in the sensor cable just behind the sensor head to allow approximate measurement of process temperatures.

The 8-mm sensor is rated for operation up to 200 °C, and its dielectric and thermocouple signals are routed through a 10-foot (3 m) long Viton tubing to a standard dielectric connector. The 0.5-inch sensor is rated for operation up to 250°C uses a 10-foot (3 m) long steel conduit.

The single electrode of the 8-mm and 0.5-inch sensors requires a nearby grounded metal surface for proper sensor operation. The configuration is effectively a set of parallel plate electrodes which needs correct determination of A/D ratio and base capacitance for accurate calibration. A/D ratio and base capacitance are typically measured experimentally and depend on exact mold and mounting configuration.

SPECIFICATIONS (Available with side or rear exit conduit)

	8 mm unsheathed	**0.5" sheathed**
Dimensions		
Diameter	: 8.0 mm nominal	12.6 mm (0.5 inch) nominal
Height	: 11.0 mm nominal	14.3 mm (0.563 inch) nominal
Length, conduit	: 10' (3 m) nominal	10' (3 m) nominal
Diameter, electrode	: 6.0 mm	6.0 mm
Area, electrode	: 0.282 cm^2	0.282 cm^2
Composition:		
Electrode	: Stainless steel	Stainless steel
Insulator	: Vespel	Vespel
Conduit	: Viton	Steel
Cabling	: Teflon insulated	Teflon insulated
Operational:		
Temperature, maximum	: 200 °C (392 °F)	250 °C (482 °F)

Sensor Parameters:

A/D ratio : 0.282 cm^2 / (mold gap)
Note—A/D ratio is typically determined empirically and varies with exact mold and mounting configuration

Base capacitance : Determined empirically

Optional thermocouple : Type J standard,
Type K available upon request

Measurement, mid-con mode:

Log Conductivity : Range varies with A/D ratio
Log Ion Viscosity : Range varies with A/D ratio
Log Loss Factor : Range varies with A/D ratio
Permittivity : Not recommended for accurate measurement of permittivity, although trends are indicative

Measurement, high-con mode:

Log Conductivity : Range varies with A/D ratio
Log Ion Viscosity : Range varies with A/D ratio
Log Loss Factor : Range varies with A/D ratio
Permittivity : Not applicable

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OPERATING MODES

The single electrode sensors may be used with all Lambient Technologies dielectric instruments in either mid-conductivity or high-conductivity mode. The sensor makes a bulk measurement of material between its single electrode and the surrounding metal, typically the opposite platen of the mold, in a parallel-plate configuration. The calibration factor for single electrode sensors is the *A/D ratio*, which refers to the ratio of the area of a parallel plate electrode divided by the distance between the plates. In the ideal case where mold separation distance D is much less than the electrode radius R, the A/D ratio for the 8 mm sensor is given by equation 1:

(eq. 1) A/D = Area of electrode / plate separation

Where: $A = \pi * R^2 = 0.282\ cm^2$
D = separation of mold platens (cm)
R = electrode radius = 0.3 cm

And: $D << R$

Note that the A/D ratio has units of ***cm*** for use with CureView software.

Because fringing electric fields to the surrounding mold make equation 1 less accurate for larger values of D, the A/D ratio and base capacitance are most accurately determined experimentally.

For proper use of single electrode sensors, the metal platen holding the sensor must be grounded. The ground of the platen must be connected to the chassis ground of the dielectric measurement instrumentation as shown in Figure 2. If an upper platen is used, it must be grounded, also.

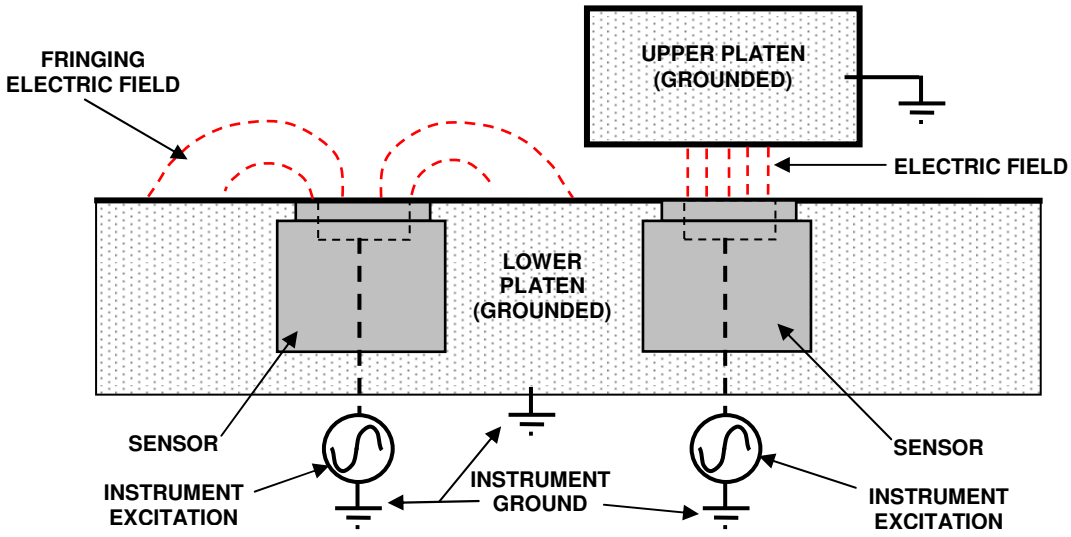

Figure 2
Proper grounding of platens or mold

SIDE EXIT 8-mm SENSOR FORM FACTOR

The side-exit 8-mm sensor has the dimensions shown in Figure 3. Dimensions in brackets are in mm. Dimensions not in brackets are in inches.

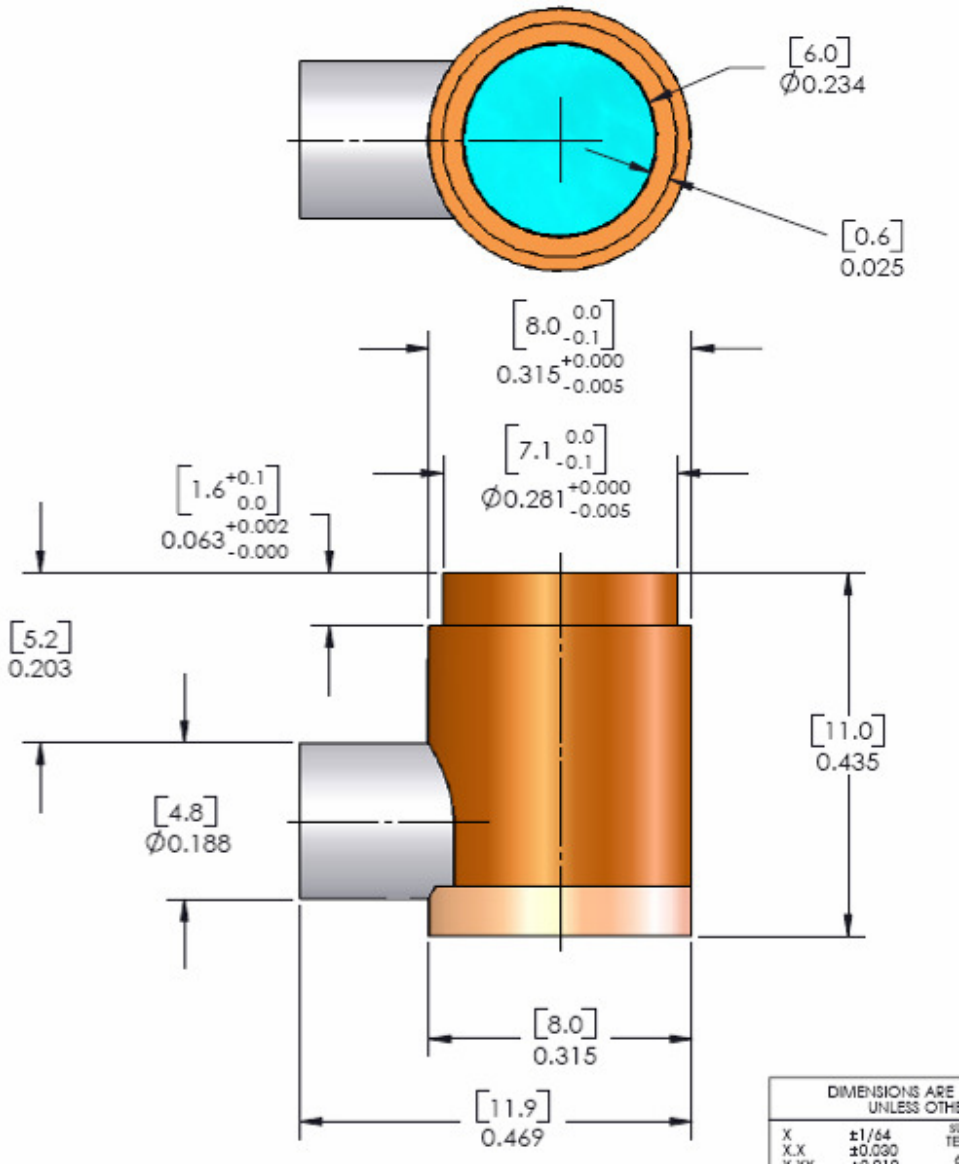

Figure 3
Dimensions of side exit 8-mm sensor

REAR EXIT 8-mm SENSOR FORM FACTOR

The rear-exit 8-mm sensor has the dimensions shown in Figure 4. Dimensions in brackets are in mm. Dimensions not in brackets are in inches.

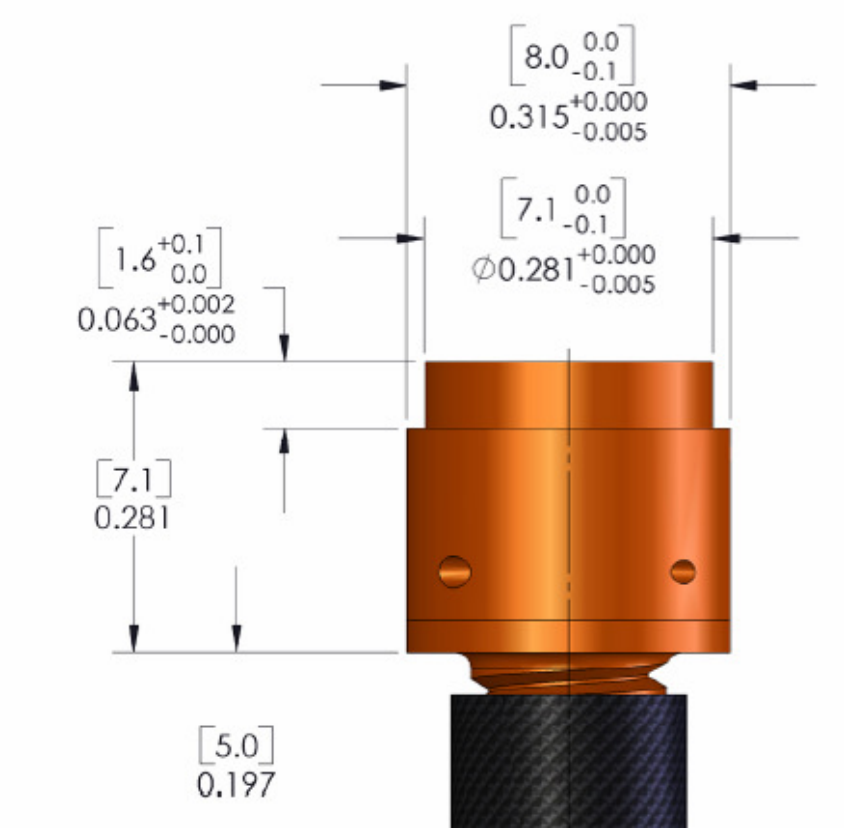

Figure 4
Dimensions of rear exit 8-mm sensor

SIDE EXIT 0.5-inch SENSOR FORM FACTOR

The side-exit 0.5-inch sensor has the dimensions shown in Figure 5. Dimensions in brackets are in mm. Dimensions not in brackets are in inches.

(Dimensions not yet available)

Figure 5
Dimensions of side exit 0.5-inch sensor

REAR EXIT 0.5-inch SENSOR FORM FACTOR

The rear-exit 0.5-inch sensor has the dimensions shown in Figure 6. Dimensions in brackets are in mm. Dimensions not in brackets are in inches.

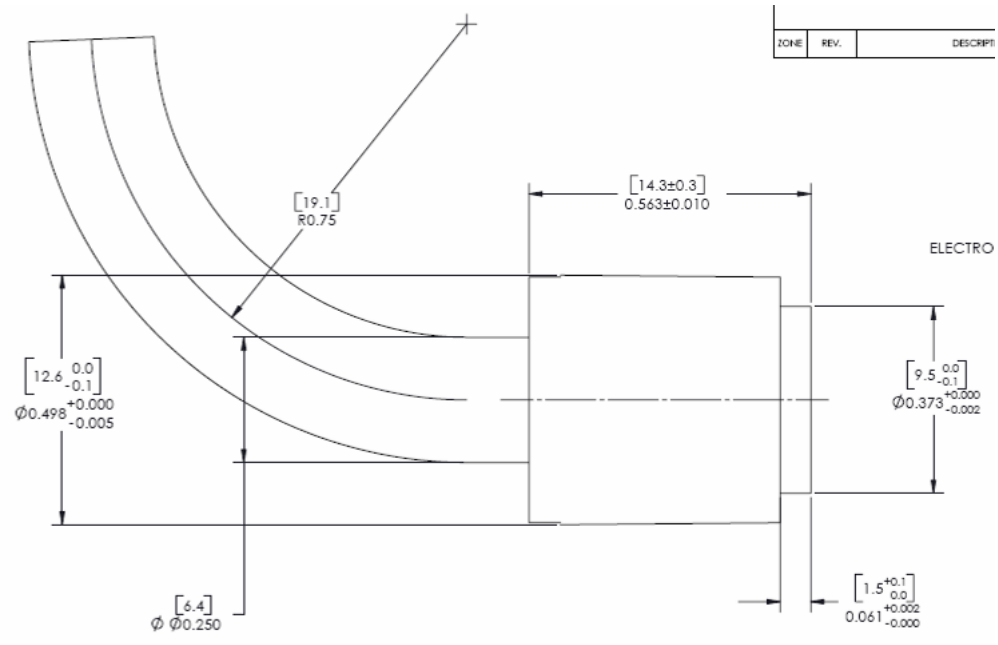

Figure 6
Dimensions of rear exit 0.5-inch sensor

INSTALLATION

The single electrode sensors are designed for optimal mounting from the rear side of a mold or platen as shown in Figure 7. It is recommended that silicone lubricant be applied to the side of the sensor before installation, to facilitate removal when necessary.

It is important to support the rear side of the sensor to prevent high pressures from pushing it into the mold or platen.

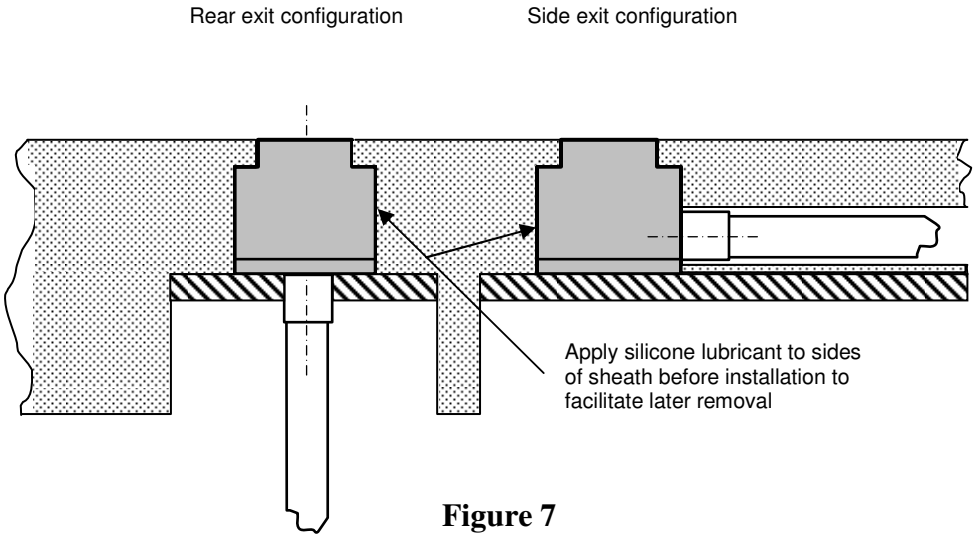

Figure 7
Sensor installation
Mounting from rear

CARE AND HANDLING

Always apply mold release to the surface of the sensor before use with curing material. A silicone based mold-release is recommended to reduce conductive contributions to the measurement. Damage to the sensor may result if mold release is not used and cured material is peeled from the surface.

Do not apply excessive strain to the conduit. The conduit is securely attached to the sensor body, but the signal wires inside it and not designed to withstand excessive pulling forces.

CLEANING

Careful use of a spatula or other scraping tool to remove samples will not damage the sensor, provided that mold release was applied to the sensor before curing.

Clean sensors with acetone, trichlorethlyene or other solvent to remove oils and contaminants. Solvents or water adsorbed onto the surface of the sensor normally will not interfere with cure monitoring because it is released at elevated temperature, and would not be present at typical process temperatures.

At room temperature, however, adsorbed solvent or water will appear as an additional conductive component and may dominate the measurement. In this case the

gains in air may be elevated (less negative, approaching 0 dB at low frequencies) and phases may be significantly negative. Heating the sensor above 100 °C for a short time should remove adsorbed material.

LAY-UP TECHNIQUES

1. Place samples on the sensor, insuring good contact with the electrodes.

2. Solid samples, or solid samples which melt during processing, will require applied pressure. The sensors are designed to withstand high pressures and temperatures up to 200 °C for the 8-mm unsheathed sensor and 250 °C for the 0.5-inch sheathed sensor.

3. Composite materials containing graphite or other conductive fibers will require use of a filter layer to prevent shorting of the electrodes. Glass cloth with small pore size, or fiberglass felt, is recommended for these situations.

INSTRUMENT COMPATIBILITY

Compatible with:

Micromet Instruments/Holometrix-Micromet

Eumetric System II Microdielectrometer
Eumetric System III Microdielectrometer
Eumetric 100A
ICAM 1000/1500/2000
MDE Series 10/20 Cure Monitor

NETZSCH Instruments

DEA 230/1
DEA 230/2
DEA 230/10
DEA 231/1
DEA 231/4

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